

## II. HOW IS CANNABIS CONSUMED?

### How is cannabis procured?

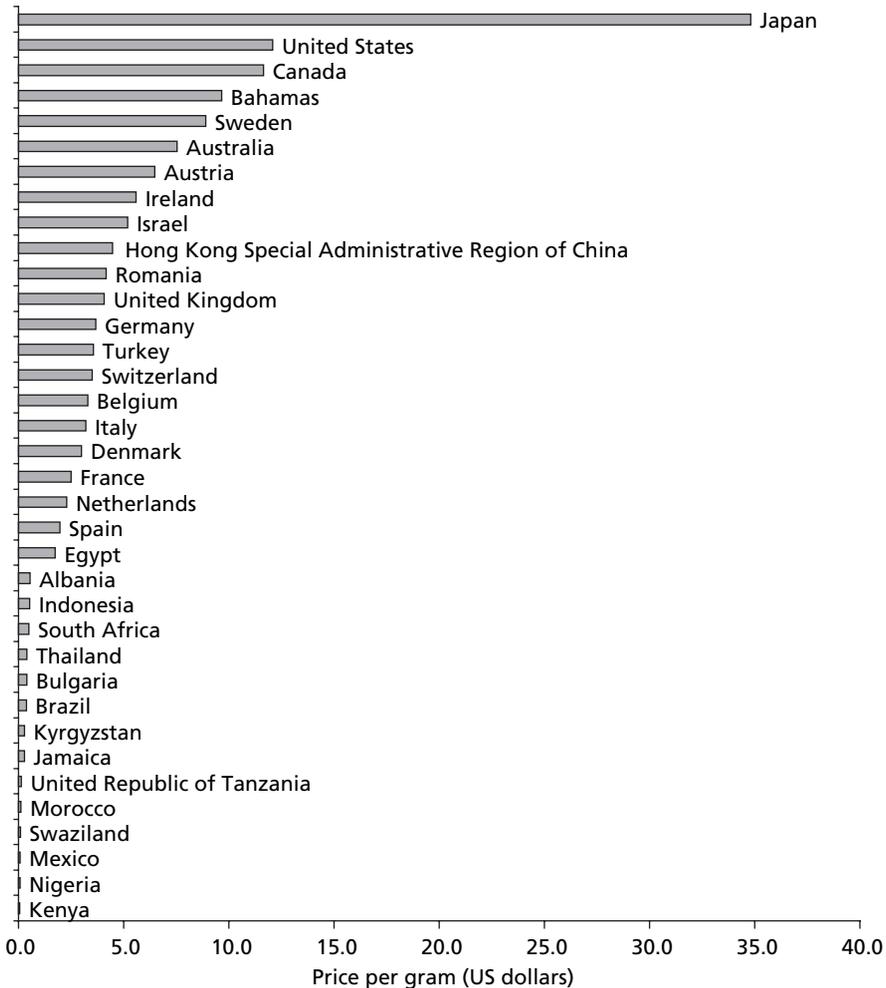
While substantial seizures prove that large quantities of both cannabis herb and cannabis resin are trafficked internationally, it is far from clear what share of the overall market this represents. Given the wide range of locations in which the cannabis plant can be grown and its low volume-to-value ratio relative to other drugs, it appears that the movement of cannabis between continents is declining in favour of greater domestic production. According to survey data, a sizable share of cannabis users either grow their own cannabis or acquire it through local social networks, rather than through impersonal vendors tied to international syndicates. With the possible exception of some amphetamine-type stimulants, cannabis is the only drug where the entire market chain, from production to consumption, can be contained in a single individual.

Unlike many other drugs, the price of cannabis remains very low in most countries. In producer countries in the developing world, it is sometimes cheaper to get “high” on cannabis than it is to get drunk on beer. In South Africa, for example, the price of a matchbox full of cannabis buds has been about 4 rand for years (just over 50 United States cents), less than a bottle of beer in a bar [56]. In Singapore, cannabis has, in the past, been used by worker communities as an inexpensive substitute for alcohol [57]. Even in developed countries, the price of a dose of cannabis remains low. As might be expected, prices are lowest in various poor countries where cannabis is produced (such as Colombia, India, the Lao People’s Democratic Republic and various African countries) and highest in the developed countries, especially where law enforcement is strong (such as Japan, Sweden and the United States). The United States is one of the more expensive places in the world to buy cannabis; an average price in the United States of \$300 an ounce sounds substantial, until it is pointed out that a dose sufficient to get a casual user “high” costs less than \$5.

Continuing with the example of the United States, the price of cannabis in the United States has been relatively stable, between \$10 and \$20 per gram for small buyers throughout most of the 1980s and 1990s.

As a result, users can afford to be generous. Cannabis is usually consumed communally, with a single cannabis cigarette being passed around. In France, 82 per cent of occasional users (between one and nine incidents of use in the survey year) never consume the drug alone. Even among regular users (between 10 and 19 incidents of use per month), 20 per cent never consume alone and only 20 per

Figure VI. Price of herbal cannabis in selected countries and areas

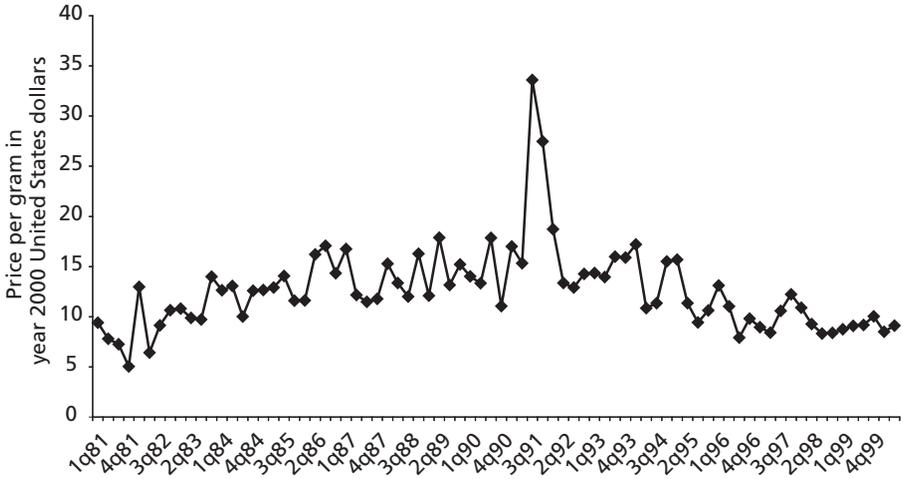


Source: UNODC annual reports questionnaire.

cent report they “often” do so [59]. In New Zealand in 2001, only 4 per cent of users surveyed said they smoked alone during a “typical” consumption session ([60], p. 36). Moreover, this phenomenon is not unique to casual users: surveys among regular users in the United Kingdom show almost all of them (96 per cent) share cannabis cigarettes at least some of the time ([61], p. 16).

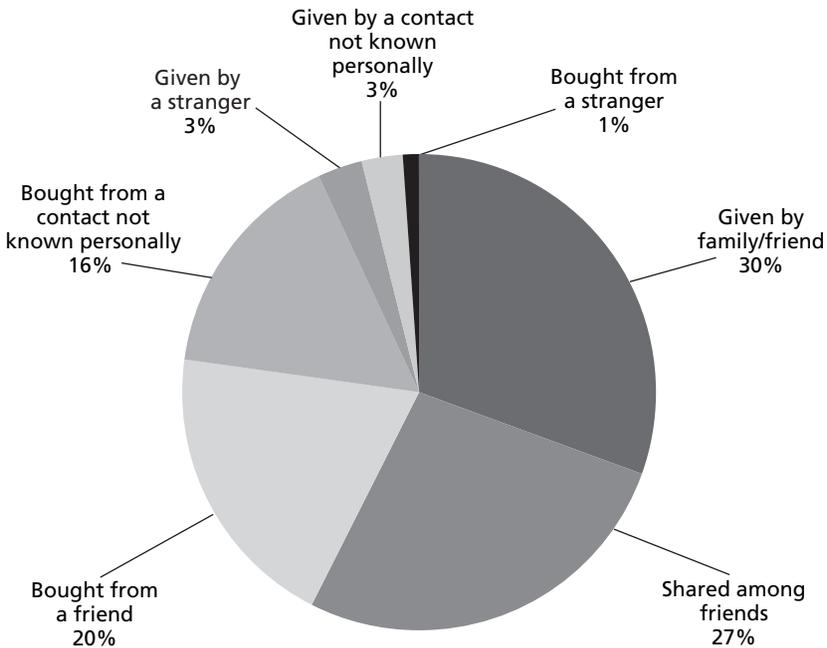
Since the drug is shared, users do not always pay for the portion they consume. According to household survey data taken in the United States, a majority (57 per cent) of users said they obtained the cannabis they had used most recently for free or that they had shared someone else’s cannabis ([62], p. 22). In Ireland, the figure is 64 per cent (see figure VIII) [24]. In New Zealand, 84 per cent of annual cannabis

**Figure VII. Price in the United States of a gram of cannabis for a small buyer (less than 10 grams) in year 2000 dollars, 1981-1999**



Source: United States, Office of National Drug Control Policy [58].  
Note: The letter "q" stands for "quarter". Thus, "1q81" means the first quarter of 1981.

**Figure VIII. Source of cannabis on most recent occasion of use among survey respondents in Ireland**



Source: Ireland, National Advisory Committee on Drugs and Drug and Alcohol Information and Research Unit [24].

users received at least some of their cannabis for free, with 20 per cent receiving “most” and 1 per cent “all” of their cannabis for free ([63], p. 229).

A detailed analysis of data from a survey conducted in 2001 in the United States found that 43 per cent of users had bought none of the cannabis they had used in the previous year, despite using the drug an average of 30 days during that time. This analysis argues that “most marijuana users are ‘distributors’, [but] most do not report selling marijuana” ([64], p. 173).

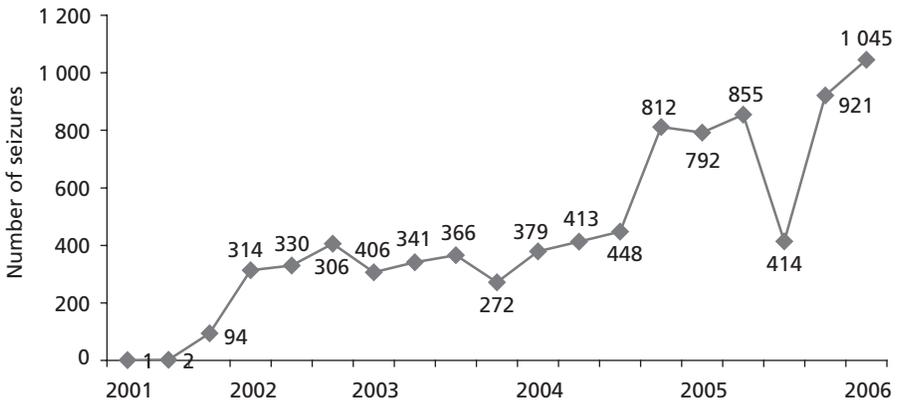
Another reason users can be relatively free with their drugs is that many people produce the drug for personal use or for their social circle. In New Zealand, a household survey found that 10 per cent of all current users had grown at least some of their own supply ([60], p. 36). According to the response of Belgium to the UNODC annual reports questionnaire in 2003, production for personal consumption was on the increase in Belgium and some 70 per cent of the cultivation operations detected (totalling 258 in 2003) involved less than six plants. The proportion of people cultivating cannabis plant for personal use is much higher among those who use the drug frequently. A survey of regular users in Australia found that two thirds of respondents grew some cannabis plant for their own use and nearly half grew all or most of the cannabis they used ([23], p. 54). This tendency is not limited to areas with good conditions for growing cannabis plant, such as Australia. Atha and others in the United Kingdom found that 63 per cent of a sample of regular users reported having grown the drug at some point in their lives, growing an average of 24 plants. The authors note that “most home-grown [cannabis] is not sold”. They estimate that 30 per cent of the cannabis used by regular users in the United Kingdom was home-grown in 1997 ([35], p. 16). A total of 66 per cent of cannabis was estimated to have been home-grown in 2005 [65]. If this is correct, a significant share of the cannabis used in the United Kingdom is produced and distributed free within the country. A second study concurs: “domestic production is on the increase and as much as half of the cannabis consumed in England and Wales may be grown here. Some cultivation is on a commercial basis, but much is on a small scale, for personal use or use by friends” ([66], p. 1). As this second study suggests, what these small growers do not use or give away, they often sell within their social circle. According to household survey data in the United States, most (78 per cent) of those who say they bought cannabis in the past year say they bought it from “a friend”. Similar figures were found in an international comparative study of cannabis users in Bremen, Germany (80 per cent), and San Francisco, United States (95 per cent) ([67], p. 395).<sup>\*</sup> As figure VIII shows, only 1 per cent of annual users surveyed bought cannabis from a stranger in Ireland [24]. Distribution among social groups mitigates many of the negative effects associated with drug markets dominated by organized criminal groups. It also suggests that law enforcement efforts typically used in combating other drug markets are unlikely to show much success in the case of cannabis.

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<sup>\*</sup>The study also included users in Amsterdam, the Netherlands, most of whom bought their cannabis from a “coffee shop”.

Even outside networks of friends, it is unclear how much cannabis is trafficked in the sense of being smuggled across borders from production to consumer sites. While substantial international trafficking in cannabis does occur, it also appears that consumers in several countries are coming to rely more and more on domestically produced cannabis. In the United States, for example, the estimated share of cannabis derived from domestic cultivation has increased dramatically in recent years. In 1986, it was estimated that one sixth of the cannabis consumed in the United States was produced within the country [68], but there are strong indications that this share has increased, including an increase in indoor production and “guerrilla” cultivation operations on public lands ([37], p. 43). Similarly, in Canada in 1985, only 10 per cent of the cannabis consumed was produced domestically [69], but by 2002, it was estimated that “well over half” was grown in Canada [36]. In the United Kingdom, as noted above, an estimated 30 per cent of the cannabis used by regular users was home-grown in 1997, ([35], p. 16) increasing to 66 per cent in 2005, and supplies from India, Morocco and the Netherlands appear to have decreased [65]. This is also confirmed by an increase in the number of all cannabis seizures that involved whole plants, from one in the second quarter of 2001 to 921 in the third quarter of 2005 (see figure IX), nearly as many as the number of cannabis resin seizures (of which there were 968) [55]. In the Netherlands, the trend has been moving away from imported cannabis resin and towards domestically produced sinsemilla and cannabis resin. Other countries have always been fairly self-reliant in terms of cannabis supply. Almost all the cannabis consumed in Australia and New Zealand is domestically produced for example [70]. Even imports from nearby developing countries appear to have waned in Australia, as they have been replaced by locally grown, high potency strains ([71], p. 62).

Figure IX. Seizures of cannabis plants in the United Kingdom by quarter, 2001-2006



Source: United Kingdom, Forensic Science Service [55].

## How is cannabis consumed?

Most cannabis herb is smoked, but there are many ways of doing this and each culture where the drug is used seems to produce its own various methods. Perhaps the most popular technique is to make a kind of cigarette (known as a “joint”) using specialty rolling paper or other material (such as scrap paper or the leaves of local plants). In Ireland, for example, 98 per cent of people surveyed who had used cannabis (herbal or resin) in the past month said smoking cannabis cigarettes (“joints”) was one of the ways they consumed cannabis, with the second most popular response being pipes (7 per cent) [24]. In Europe, a filter is often used, sometimes taken from a tobacco cigarette. Cannabis herb is generally smoked with tobacco in Europe, parts of Asia, North Africa, Australia and New Zealand, but not in most of sub-Saharan Africa,\* the United States or Canada.\*\*

Other popular cannabis smoking techniques include:

- Pipes, including both specially made and tobacco pipes, often with a foil screen.
- Water pipes, hookahs, “hubble bubbles” or bongs, in which the smoke is cooled by passing through a water chamber.
- Cigars that have been emptied of their tobacco contents and refilled with cannabis (referred to as “blunts” in the United States after Philly Blunts, a popular cigar brand).
- Vaporizers, modern machines that heat, but do not burn, the cannabis, releasing the THC into a plastic bag for inhalation.
- Makeshift devices, such as hollowed out apples, beer-can bongs, etc.
- More exotic techniques, such as the “chillum” (a large, horn-like, clay pipe used in India and Jamaica), and others.

Cannabis (typically the resin) can also be eaten. THC is fat-soluble and so cannabis can be included in a range of food products and is typically consumed in baked goods. The subjective effects of eating cannabis are different from the experience of smoking, due to different metabolic processes involved in absorbing the drug. It is clear that the onset is slower and the duration longer when cannabis is eaten.

The amount consumed is related to the method of consumption. Vaporization is said to require twice as much cannabis and eating four times as much to produce the same effect [41]. Although there is considerable variation, the typical bowl on a bong is large enough to accommodate about one twentieth of a gram of cannabis, but most bong smokers will reload the bowl several times in a session. Pipes made

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\*One exception is the mixture of “majat” (low-grade cannabis treated with a solvent) and tobacco used to smoke methaqualone (the so-called “white pipe” mixture).

\*\*For example, one study of regular users in New South Wales, Australia, found 79 per cent of users mixed their cannabis with tobacco ([23], p. 25).

specifically for smoking cannabis tend to have much smaller bowls than tobacco pipes. A good example is the “sebsi” used in Morocco to smoke “kif”, a mixture of cannabis and tobacco. The bowl of a “sebsi” is typically very small. In contrast, the “chillum” used in India and Jamaica can hold vast amounts of cannabis, but these are commonly used by people who consume the drug for religious purposes, not casual users.

The amount of cannabis found in a cannabis cigarette depends on whether tobacco is included (see table 5),\* whether single or multiple rolling papers are used and the strength of the cannabis. Studies of cannabis cigarette size in the United Kingdom in the 1970s suggested that between a seventh and a third of a gram of cannabis was included in a cigarette, [73, 74] and more recent research in Ireland and the United Kingdom\*\* has found that this has changed little over the years. This may be because of the local consumption culture: cannabis cigarettes smoked in the United Kingdom and in Ireland are typically mixed with tobacco and a single rolling paper is used, so there is little room for more cannabis.

Cannabis cigarettes in the Netherlands are typically composed of the tobacco of one cigarette with a small amount of high potency cannabis. “Coffee shops” in the Netherlands offer pre-rolled cannabis cigarettes, with a filter, containing about 0.1 g of cannabis and 0.9 g of tobacco and cannabis cigarettes sold on the street average around 0.25 g of cannabis [40] (see table 5). A study in the Netherlands showed life-sized pictures of cannabis cigarettes to 400 frequent users and asked them to indicate which picture represented what they typically consumed. On this basis, an average of 0.16 grams of cannabis per cannabis cigarette was found to be an average, or over 6 cannabis cigarettes to the gram. This was much less than what users themselves estimated they used when asked directly how many cannabis cigarettes they thought they got from a gram of cannabis: four, or 0.25 grams per cannabis cigarette [76]. This tendency to overestimate consumption should be kept in mind in evaluating other self-reported use data.

Figures from the United States are much higher, because tobacco is rarely used, low-potency cannabis from Mexico dominates the market and “multi-skin” cannabis cigarettes are common. Estimates range from 0.4 grams [77], to 0.5 grams [39], to 0.8 grams,\*\*\* to an entire gram or more in a single cannabis cigarette (see table 5).\*\*\*\* “Blunts” can contain up to 3 grams of cannabis [78], but the product used is typically low-grade. Jamaican “spliffs” can be about 10 centimetres long and were once said to contain as much as 2 or 3 grams of cannabis [79].

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\*One British study of heavy users in treatment found that those who did not mix their cannabis with tobacco were able to garner fewer cannabis cigarettes per gram of cannabis than those who mixed [72].

\*\*Cannabis cigarettes in Ireland tend to fall in the middle of the spectrum found in the United Kingdom (0.18-0.26 grams). Cannabis cigarettes rarely exceed half a gram [75].

\*\*\*This is the typical size of cannabis cigarettes formerly produced by the United States Government for medical use, prepared from the low-THC cannabis grown at its University of Mississippi farm.

\*\*\*\*Some medical users who have developed a tolerance may use cannabis cigarettes this size ([41], p. 3).

**Table 5. Variations in size of cannabis cigarettes**

<i>Country</i>	<i>Cannabis per cigarette (Grams)</i>	<i>Addition of tobacco</i>	<i>Made up mostly of sinsemilla</i>	<i>Cigarettes per gram of cannabis</i>
Canada	0.2-0.33	Sometimes	Yes	3-5
Ireland	0.15-0.25	Yes	Yes	3-7
Jamaica	2-3	No	No	0.5-0.33
Netherlands	0.1-0.25	Yes	Yes	4-10
United Kingdom	0.15-0.33	Yes	Yes	3-7
United States	0.4-0.5	No	No	2

For most users, a cannabis cigarette should not be seen as a unit of consumption because these are usually consumed communally. As will be discussed below, most users who do not consume cannabis on a regular basis would be hard pressed to smoke an entire cannabis cigarette on their own in a single sitting. As a result, an increase in cigarette size does not necessarily indicate an increase in consumption.

Other drugs are often used in tandem with cannabis, either in sequence or simultaneously. Alcohol is often consumed with cannabis. Cannabis is used to ease the “come down” from ecstasy (methylenedioxymethamphetamine) use. The “white pipe” combination of methaqualone, tobacco and low-grade cannabis (“majat”, possibly treated with a solvent) is the primary way methaqualone is consumed in South Africa [56]. Use of cannabis cigarettes laced with phencyclidine (1-(1-phenylcyclohexyl)piperidine) (PCP) or “embalming fluid” (which may include PCP) [80] is a small-scale but recurring practice in the United States [81]. Crack, heroin and methamphetamine can be mixed with cannabis and smoked, but this is not an efficient means of consuming the other drugs. In many parts of the Caribbean, the presence of cannabis cigarettes spiked with crack has been noted [82].

### **Demand-side production estimates**

To produce demand-side estimates of total cannabis production, three things need to be known:

- What share of the global population consumes cannabis annually?
- How many days in a year do they consume it?
- How much do they consume on the days when they use the drug?

One key issue in trying to determine the amount of cannabis required to meet global demand (in tons) is that not all cannabis is created equal. Cannabis resin and sinsemilla are concentrated forms of the drug and consumers use less of these drugs (in terms of weight) than they would of low-grade cannabis herb. In order to

relate demand to production, the markets for these products need to be calculated separately, but there is very little reliable data on what share of the market they command.

### *What share of the global population consumes cannabis annually?*

Answering this question requires some extrapolation, as there are massive gaps in the survey data globally. The traditional approach is to use subregional averages to calculate use levels for those countries for which data are lacking. It is also possible to extend data from a limited subsample of the population (the most obvious example being school surveys) to the population as a whole on the basis of ratios determined from countries where both sets of data exist.

Of course, all this hinges on the survey data. There has been considerable debate about the veracity of self-reporting on matters involving criminal activity\* and the level of inaccuracy may vary considerably by cultural context: in areas where drug use is highly stigmatized, subjects may be unwilling to report use, even if confidentiality is assured. Cases in point may be found in Latin America, where large quantities of cannabis are regularly seized but where annual use rates are generally low (less than 5 per cent). In some instances (such as Mexico), this is because of the existence of large export markets, but that is not always the case. Brazil, for example, claims an annual use rate of less than 1 per cent, yet it also consistently reports some of the highest volumes seized in the world. Most of this must be for domestic consumption, as the bulk of the region's cannabis markets are supplied from Colombia and Paraguay, and Brazil is not known as the source of major supplies to any other region. On the other hand, surveys in some countries show such high rates of admitted use that underreporting levels must be very low. For example, in Scotland, lifetime prevalence among 14 year olds has been found to be as high as 70 per cent [84].

With these caveats in mind, survey data show that cannabis is far and away the most commonly consumed street drug in the world. An estimated 162 million people used cannabis in 2004, equivalent to 4 per cent of the global population between the ages of 15 and 64 years (see table 6). In some parts of the world, cannabis herb is the most popular, while in others people prefer cannabis resin, but most Member States say that cannabis is the most widely used illicit substance in their countries. Cannabis use is most prevalent in the Oceania region, followed by North America and Africa. It is less common in Asia, but owing to the size of the population, Asia still contains about a third of global cannabis users.

It also appears that cannabis use is increasing. According to expert opinions solicited from Member States, far more countries felt that cannabis use was

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\*For a discussion of the reliability of the survey data, see National Research Council [83].

increasing (46 per cent of 101 countries responding) than declining (16 per cent) in 2003. In the last decade, the consensus is that cannabis use has been growing faster than use of cocaine or opiates.

**Table 6. Annual prevalence of cannabis use by region, 2003-2005**

	<i>Number of users</i>	<i>Proportion of the population aged 15-64 years (percentage)</i>
<b>Europe</b>	30 800 000	5.6
Western and Central Europe	23 400 000	7.4
South-eastern Europe	1 900 000	2.3
Eastern Europe	5 500 000	3.8
<b>Americas</b>	36 700 000	6.4
North America	29 400 000	10.3
South America	7 300 000	2.6
<b>Asia</b>	52 100 000	2.1
<b>Oceania</b>	3 200 000	15.3
<b>Africa</b>	39 600 000	8.1
<b>Total</b>	<b>162 400 000</b>	<b>4.0</b>

*Sources:* UNODC annual reports questionnaire data; Government reports; reports of regional bodies; and UNODC estimates.

In Europe, for example, school surveys among students aged 15-16 years found that the share of students reporting having ever tried cannabis rose by an average of almost 25 per cent between 1999 and 2003, for a total increase of more than 80 per cent between 1995 and 2003. The increase seems to be most pronounced in Central and Eastern Europe, where usage among young people has become almost as common as in Western Europe in recent years.

However, expert opinion in the Netherlands indicates that while more young people are consuming cannabis, they consume it less frequently and in lesser quantities than was the average in the past [85, 86]. The countries where cannabis consumption is most common, namely Australia and the United States, have not shown increases. The share of students aged 15-16 years in the United States reporting having tried cannabis fell by 14 per cent between 1999 and 2003. Annual prevalence of cannabis use among the general population and among high-school students in the United States is about a third less than it was in the late 1970s [87, 88, 89]. Cannabis use among the general population in Australia has declined by almost 37 per cent since its peak in 1998 [90].

### *How many days a year do cannabis users consume the drug?*

Of course, the 162 million people who use cannabis around the world do not all consume cannabis at the same rate. Some of them may have experimented with the

drug once or twice, while others consume the drug on a daily basis. It is estimated that 10 per cent of people who try cannabis will progress to daily use for some period of their lives, with a further 20-30 per cent using the drug on a weekly basis [91]. This leaves, however, a large share of people whose use is less frequent. The extent of use tends to vary depending on the stage in life of the user. For example, about 60 per cent of French 19-year-old boys have tried cannabis and, of these, more than one in three uses cannabis 20 times a month or more. This share drops greatly in later life stages [59].

Understanding global cannabis demand requires the creation of a typology of users and the obvious source for the data on which to base this typology is household and school survey data. Unfortunately, while the number of people who have used cannabis during the previous month (past-month users) is often a feature of the standard surveys, more precise questions about the number of days the drug was used are often lacking.

In the United States, the National Survey on Drug Use and Health (formerly known as the National Household Survey on Drug Abuse) has been conducted regularly since 1972. According to data from the survey, of the 25 million United States citizens over 12 years of age who used cannabis in 2003, 14.5 million of them said they had used it in the past month, or about 58 per cent. This is almost exactly what has been found in Australia, where 60 per cent of annual users consumed the drug in the past month [90]. A similar share is seen in the Netherlands (61 per cent), with slightly lower levels seen in France (52 per cent), Greece (53 per cent), Ireland (51 per cent) and Latvia (47 per cent).<sup>\*</sup> A slightly higher level is seen in the United Kingdom (63 per cent) ([92], p. 47).

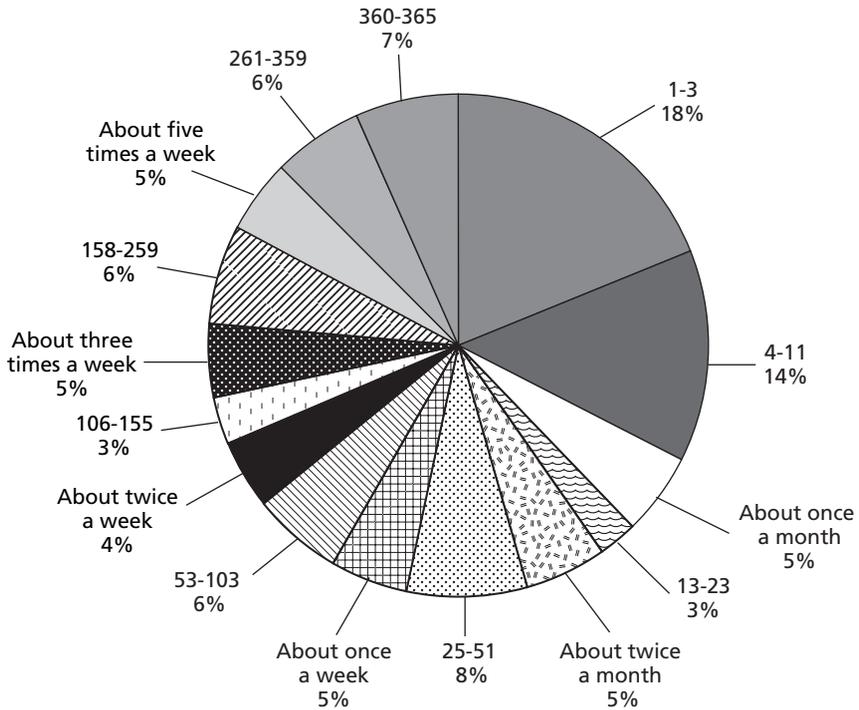
For a small share of these respondents, their use in the past month may have been the only time cannabis was used in the past year. In other words, use in the past month does not mean that the drug was used every month of the previous year: past-month use does not mean monthly use. This would suggest that the share of annual users that are also monthly users would be slightly lower than the figures discussed above. On the other hand, some heavier users might, for whatever reason, have not used cannabis in the previous month. Data from the United States (discussed below) show that 68 per cent of the annual respondents said they used cannabis 12 or more times per year (i.e., on average once a month). Thus it would appear, if any conclusion can be drawn, that the number of those who say they used cannabis in the past month may be slightly less than the number that used cannabis on a monthly basis (12 or more times in the past year). For the purposes of this discussion, 55 per cent of the annual users will be designated “regular” (about once a month or more) users and 45 per cent will be designated “casual” (less than 12 times in the previous year) users.

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<sup>\*</sup>Based on data from EMCDDA.

The household survey data from the United States provide more detailed information about the exact number of days annual users consumed cannabis. Users were able to state their estimated cannabis use as the number of days they had used in the past year, or the average number of days they used per month, or the number of days they used in a typical week. As a result, the data have strong nodes at once a month (5 per cent), twice a month (5 per cent), once a week (5 per cent), twice a week (4 per cent), three times a week (5 per cent) and five times a week (5 per cent). Figure X shows the estimated number of days cannabis was consumed in the past year by annual users. Overall, about 32 per cent of the respondents said they consumed cannabis less than once a month (11 times or less); a full 5 per cent said they smoked cannabis about once a month (12 times); another 16 per cent said they consumed cannabis more than once a month but less than once a week (13-51 times); about 5 per cent said they consumed cannabis once a week (52 times); around 24 per cent said their consumption was more than once a week but less than five times a week (53-259 times); 5 per cent said they used cannabis five times a week (260 times); and 13 per cent said they consumed it more than that (261-365 times).

**Figure X. Number of days cannabis was used in the survey year, United States**



Source: United States, National Survey on Drug Use and Health.

In Australia, National Drug Strategy Household Surveys have been conducted regularly since 1998. According to the 2001 data, 16 per cent of annual users over 14 years of age consumed the drug every day, 23 per cent once a week or more, 12 per cent about once a month and 49 per cent less often [90].

Comparing the figures from Australia and those from the United States shows a different breakdown in levels of usage between the two areas. Only a third (32 per cent) of users in the United States said they consumed the drug less than once a month, whereas nearly half (49 per cent) of those surveyed in Australia fell into this category. On the other hand, 16 per cent of cannabis users in Australia were daily consumers, compared to just 7 per cent of respondents in the United States. Taken at face value, data concerning Australian users seem to be at the extremes, with users in the United States more likely to fall somewhere in the middle. If the categories are made somewhat less exact, however, the fit is better. For example, if “daily” use is considered to be five times or more per week, 18 per cent of respondents in the United States meet the criteria, close to the figure for users in Australia of 16 per cent. New Zealand uses a softer standard for “heavy” use: 10 or more times in the past month, but 20 per cent of annual users fall into this category ([60], p. 27).

Statistics from European household surveys as compiled by EMCDDA show rates of cannabis use among those who have used in the past 30 days. These figures show that between 1 per cent (Finland) and 7 per cent (Spain) of those who had used cannabis during the year had also consumed the drug in the past 30 days. Among past-month users, between 5 per cent (Latvia) and 34 per cent (Spain) had consumed the drug more than 20 days out of the past 30 and are designated by EMCDDA as “daily or almost daily users” (see table 7).

**Table 7. Frequency of cannabis use among all users in selected European countries in the past 30 days**

Country	Year	Annual prevalence (percentage)	Respondents who had used in past 30 days (percentage)	Number of users	Number of days used per month (percentage)			
					1-3 days	4-9 days	10-19 days	20+ days
France	2000	8.4	4.4	497	42.5	15.5	15.5	26.4
Greece	1998	4.4	2.3	104	37.7	27.3	15.6	19.5
Ireland	2002/2003	5.1	2.6	126	40.9	22.3	14.3	22.5
Italy	2001	6.2	4.7	171	38.0	30.4	12.3	19.3
Latvia	2003	3.8	1.8	81	57.1	24.2	13.3	5.4
Netherlands	2000/2001	6.1	3.7	744	41.5	21.1	13.8	23.6
Portugal	2001	3.3	3.3	336	33.7	23.8	19.2	23.2
Spain	2001	9.7	6.8	1 058	29.5	24.8	12.1	33.6

Source: EMCDDA, *Statistical Bulletin 2004*.

Consumption on more than 20 days out of 30 would correspond to more than 240 days of cannabis use in the past year, close to five times a week or more (260 days a year). Thus, we would expect the European figures for those who have used cannabis on more than 20 days in the past month to be close to the 16-18 per cent seen in Australia and the United States and, as table 8 shows, they are in several cases.

**Table 8. Ratios of annual cannabis users to more frequent users in selected European countries**  
(Percentage)

Country	Share of respondents who are annual users	Share of respondents who are past-month users	Share of annual users who are monthly users	Share of monthly users who are daily users	Share of annual users who are daily users
France	8.4	4.4	52	26	14
Greece	4.4	2.3	53	20	11
Ireland	5.1	2.6	51	23	12
Italy	6.2	4.7	76	19	14
Netherlands	6.1	3.7	61	24	15

Source: Calculations based on EMCDDA data.

This analysis shows that survey data from a number of countries (Australia, France, Greece, Ireland, Italy, the Netherlands and the United States) show that past-month users comprise about half of annual users and that “daily or almost daily” users comprise 10-20 per cent of the annual user pool, with a mean, median and mode of 14 per cent.

There are also studies of subpopulations (generally youth) that find similar levels of daily use among annual users. In Canada, the Ontario Student Drug Use Survey deals with a subsample of the general population: young people enrolled in school grades 7-13. But this group has much higher annual use levels (29 per cent in 2001 and 30 per cent in 2003) than the general population of Ontario (11 per cent in 2000). Conducted biannually since 1981, the 2003 survey showed that 29 per cent of the annual users consumed the drug just one or two times, 13 per cent three to five times, 12 per cent six to nine times, 12 per cent ten to nineteen times, 9 per cent twenty to thirty-nine times and 25 per cent forty times or more. About 14 per cent used the drug on a daily basis ([93], p. 80). Similarly, in the United Kingdom, the Youth Lifestyles Survey (of 12-30 year olds) found that 13 per cent of the annual cannabis users consumed the drug daily [94].

Thus, sources from a wide range of countries suggest that about 14 per cent of annual cannabis users are daily users, a higher figure than might be expected. If these figures could be generalized to the total global population, this suggests that about 22.5 million people use cannabis on a daily or near-daily basis, with the other 138.5 million people using it less often. This figure is important because only

at the level of daily or near-daily use does tolerance develop and this has an impact on the amount of cannabis consumed, as discussed below.

### *How much cannabis do users consume during each day of use?*

How much cannabis do users need to consume in order to experience the desired effects? Like all drugs, cannabis dosage is highly dependant on factors such as body weight, individual metabolism and tolerance and there is limited material on what constitutes a “dose” among recreational users. There are two ways of approaching this problem, both of which are pursued below. One is to determine, on the basis of scientific testing, how much cannabis a user needs to consume to receive the desired effects. Owing to the extreme variability in potency, however, cannabis dosages would need to be expressed in the amount of THC absorbed by the system, rather than the weight of the product consumed. The second approach would be look at actual use patterns based on survey or other data.

The question of what an “average” user consumes is complicated by the issue of tolerance. Ironically, in casual users, experience with consumption may actually increase sensitivity to the effects of the drug [95]. This may be related to an improved inhalation technique, among other things. But tolerance has been documented both in the laboratory and the field. For example, one study of over 1,000 chronic users of cannabis resin found that users continuously increased their consumption levels over several years before reaching a peak and that if use was suspended, users found they could only consume a fraction of their peak dosage until tolerance was established again.\* While the extent of tolerance has not been precisely quantified, it appears to build up within a few days of chronic use and dissipate just as fast ([97], p. 257). In other words, tolerance is not an issue for anyone but daily or near-daily users, but there are likely to be stark differences in the dosage levels and, consequently, the consumption levels, between these two groups.

Determining dosage levels in a laboratory setting is complicated by a number of factors. For example, testing of blood THC levels of those known to have consumed a set quantity of cannabis demonstrates that smoking technique makes a considerable difference in the amount of THC absorbed. When smoked, only 15 per cent-50 per cent of the THC in a cannabis cigarette is absorbed into the blood stream, but experienced users are able to access about twice as much THC as casual users, because they have a superior inhalation technique ([98], p. 67).\*\*

Using this absorption range, smoking an average (United States sized) 0.5 gram cannabis cigarette of fairly good potency (say 10 per cent THC, about halfway

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\*Weiss, cited in Schafer and others [96].

\*\*One study of heavy medical users, however, also uses an absorption ratio of about 15 per cent, despite the experienced nature of the users [99].

between the 2004 United States averages for seized low-grade cannabis and seized sinsemilla) would result in the ingestion of 7.5-25 milligrams of THC. Lower potency cannabis would require more of a cannabis cigarette to be smoked, obviously, but larger cigarettes would require less.

Medical guidelines for dosage of synthetic THC (dronabinol) given orally suggest a starting daily dosage of 5 milligrams per day, administered in two doses of 2.5 milligrams. Maximum daily dosage is set at 20 milligrams and most patients are said to respond to 5 milligram dosages given three or four times a day. Of course, oral administration is less efficient than smoking, suggesting that these doses would be significantly less if the THC was smoked. On the other hand, the effects on the central nervous system desired by cannabis smokers are considered an unwanted side effect when the objective is appetite stimulation for chemotherapy patients, occurring in 3-10 per cent of such patients.\*

According to the World Health Organization (WHO), when cannabis is smoked just 2-3 milligrams are sufficient to produce the desired effect in most people.\*\* Grotenhermen argues that 0.03-0.1 milligrams of THC per kilogram of body weight is needed, or 2-5 milligrams for an adult ([100], p. 351).

Using the WHO standards, this would mean consumption of perhaps 10 per cent (with a good inhalation technique) to, at most, 40 per cent (with a poor inhalation technique) of a fairly potent cannabis cigarette should be sufficient to experience the desired psychoactive effect. This represents a "dose" level of 0.05-0.2 grams. Using Grotenhermen's upper threshold of 5 milligrams, this would be 20 per cent (with good inhalation technique) to 66 per cent (with poor inhalation technique) of a cannabis cigarette.

In other words, one average cannabis cigarette of good quality represents enough cannabis to satisfy 2-10 people, according to WHO standards. Of course, threshold levels are often exceeded. Grotenhermen adds that a "dose for a marked intoxication" would be 10-20 milligrams [100]. This is still less than an entire cannabis cigarette if the user's technique is any good.

Thus, however convenient the unit, a cannabis cigarette should not be considered a "dose". Consumption of an entire cannabis cigarette in a single sitting by a casual user would be rare, rather like a casual drinker consuming an entire bottle of wine. Cannabis of reasonable quality is actually more like spirits: just a few "shots" is enough to produce intoxication.

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\*Dosage information taken from [www.marinol.com](http://www.marinol.com).

\*\*WHO uses a much wider range of possible values in its own calculations, however, arguing that the THC in an average cannabis cigarette (0.5-1 grams of cannabis with a THC content of 1-15 per cent) ranges from 5-150 milligrams, of which 5-24 per cent actually enters the bloodstream when smoked. This gives a range of 0.25-36 milligrams of THC being absorbed from a single cannabis cigarette, so individual experiences may vary by a factor of 144.

The fact that the most common unit of consumption does not correspond to the average dose is one reason why cannabis is usually consumed communally, with a single cannabis cigarette being passed around. Under these circumstances, there is almost no lower limit to the amount consumed by casual users. In other words, survey respondents who say they have consumed cannabis in the past year (especially novice users) may have had only a few inhalations on one or more occasions.

This level of use is reflected in the survey data from New Zealand, which is unique in asking users how much they consumed on each occasion they used the drug. In 2001, the average annual user smoked just six tenths of a cannabis cigarette. This average includes the 20 per cent of annual users who were classed as “heavy” smokers (using 10 or more times in the past month), so modal values for occasional users would be much less. The New Zealand surveys also ask about sharing cannabis cigarettes and the results show that nearly all consumption takes place in groups of two or more. In 2001, only 4 per cent of respondents smoked alone during a “typical” consumption session, while 14 per cent shared with one other, 29 per cent with two others, 24 per cent with three others, 17 per cent with four others, 6 per cent with five others, 3 per cent with six others and 2 per cent with seven others. A large share (45 per cent in 2001) never bought the cannabis they consumed and another significant part (26 per cent) received at least some of their cannabis for free ([60], pp. 35-36). This is consistent with figures from the United States and Ireland.

According to at least one source in the grey literature, a standard “hit” from a bong or pipe is generally one twentieth of a gram (0.05 grams) and one to three “hits” (up to 0.15 grams) are generally enough to produce the desired effect, which lasts for two to five hours. This figure (0.15 grams) is perfectly in line with those discussed above (0.05-0.2 grams). High potency cannabis is said to be consumed in amounts of up to 0.1 grams, not more.\* The source goes on to conclude that one eighth of an ounce (3.5 grams) of mid-quality cannabis could get around 20-30 people reasonably high: between a tenth and a fifth of a gram apiece.\*\*

Further evidence of a low dose thesis is the existence of “one hitters”: pipes designed to hold just one inhalation of cannabis. While these small bowls can obviously be re-loaded, the work that involves would suggest that such a process is not intended to be frequently repeated. Imagine, for comparison, the limited utility of “one puff” tobacco cigarettes.

While there is virtually no floor to the amount of cannabis that might have been consumed by an annual user, it also seems that the ceiling on use is very high. Unlike other drugs, it is virtually impossible to “overdose” on cannabis. Experienced

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\*[www.eroid.org/plants/cannabis/cannabis\\_dose.shtml](http://www.eroid.org/plants/cannabis/cannabis_dose.shtml).

\*\*[www.erowid.org/plants/cannabis/cannabis\\_basics.shtml](http://www.erowid.org/plants/cannabis/cannabis_basics.shtml).

smokers can consume the drug continuously if there are no social barriers to their behaviour. Those who grow their own supply may also circumvent financial constraints on consumption. For these users, the only ceiling on their use is the time it takes to prepare and consume the drug.

Surveys of users in New Zealand show that 95 per cent of annual cannabis smokers surveyed said that they never used the substance at the workplace, so employment may form a major impediment to constant consumption [101]. A study of users in Amsterdam, the Netherlands, where the drug is widely tolerated, found that declining to consume at work was the single most commonly followed "rule" concerning consumption and that 27 per cent of the sample of experienced users in the survey adhered to this rule; a further 20 per cent abstained from smoking cannabis during the day and 15 per cent abstained during the morning [102]. In France, just under a quarter (24 per cent) of "heavy" (20 times a month or more) users only "sometimes" or "never" consumed in the morning or afternoon [59]. Thus, a reasonable division could be hypothesized between daily users who have a cannabis cigarette or two in the morning and/or evening and those whose lifestyles allow them to be continuously intoxicated.

One source of information on dose levels for heavy users is the literature on medical use of cannabis. There is a great deal of contradictory information on what constitutes a "normal" use pattern among medical cannabis recipients, some of which is probably rooted in the politics of the medical cannabis debate; inflated average usage figures may provide protection to those found in possession of large amounts of the drug. Using the prescription guidelines for synthetic THC as a guideline, one study found that 1-5 grams of cannabis with THC levels of 10-20 per cent would be necessary to deliver 30-90 milligrams of THC, the daily dosage of synthetic THC [99]. In other words, users needing to be constantly under the influence of cannabis would have to smoke 2-10 standard 0.5 grams cannabis cigarettes of good potency per day. The study notes that this figure corresponds to actual average use levels reported by medical cannabis projects in the states of California and Washington in the United States, as well as dosages used in clinical studies. Other reports have suggested higher amounts. One study of four long-term medical cannabis patients found consumption levels of 7-9 grams per day, although this dosage was the product of years of constant use and lower consumption levels had been adequate at earlier stages [42].

Unfortunately, the ability to generalize actual medical usage patterns to the public at large is limited because medical users tend to have access to better quality cannabis than the general public [103]. It seems likely that heavy users would also use a more potent product and would be more likely to grow their own *sinsemilla* (for financial reasons, if nothing else), but the extent to which this is true is unclear. If low-grade cannabis were used, the quantities consumed could be much greater.

Another source of information on user habits is the regulated industry of the "coffee shops" in the Netherlands. According to the Ministry of Health, Welfare

and Sports of the Netherlands, the 600,000 users of cannabis products in the Netherlands consume an average of 2 grams per week per customer [104]. Of course, this average consumption level obscures considerable variation in individual use levels and, like medical cannabis, the quality of this product is likely to be much better than that available to users in other parts of the world.

Field accounts of use levels among non-medical regular users vary in quality and the question of sampling is always an issue. The Independent Drug Monitoring Unit in the United Kingdom makes use of a sample of “regular” users gathered at “pop-festivals and pro-cannabis rallies . . . subcultural magazines, snowballing, via direct mailings to pressure groups, and at other events.” This sample is clearly not representative of annual cannabis users, but does give information on the upper end of the use scale.

The Independent Drug Monitoring Unit notes that even within this pool of users, the majority of the regular users consume relatively small amounts of the drug, with a mean consumption of 1 g per day. However, among daily users, the average was over six cannabis cigarettes a day, with some examples of much heavier use [61]. Other work in the United Kingdom also suggests that daily users may consume as many as five cannabis cigarettes a day ([105], p. 931). Informal interviews conducted in connection with the study with a number of employed daily users suggest a monthly consumption level of about 1 ounce (28 grams), which is enough cannabis for about two cannabis cigarettes a day.\*

One qualitative study of drug users in Milan, Italy, found that while most users consumed only occasionally, daily users smoked between two and five cannabis cigarettes, or 1-2 grams of cannabis, a day. One dealer, however, claimed that at one point in his life he had consumed up to 20 g in a day. A more typical user said he smoked between six and nine cannabis cigarettes a week, but cautioned, “I cannot talk about a weekly or monthly frequency because I go through phases where I don’t have as many commitments . . . or I see certain friends . . . [while] in other phases, for work or study reasons, it may happen that for about two months I smoke very rarely” ([106] p. 84).

One study of long-term, regular cannabis users in Australia\*\* found a median use pattern of two “standard” cannabis cigarettes a day (50 per cent smoked between one and four cannabis cigarettes a day), but there were some stark outliers.

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\*The standard sales unit in various locations provides some clues as to dose levels. In the United States, cannabis is sold in fractions of an ounce: one sixteenth (1.75 grams, enough for 1-2 joints), one eighth (3.5 grams, enough for 4-8 joints), one quarter (7 grams, enough for 8-14 joints), and one full ounce (28 grams, enough for up to 50 joints). A daily user consuming one or two joints a day would therefore use between a half and a full ounce per month. In Italy, cannabis resin was sold in 2000 by the deca (10,000 liras worth), which amounted to about 0.7 grams, enough for one or two cannabis cigarettes ([106], p. 121).

\*\*A total of 92 per cent used at least two times a week, 86 per cent four or more times a week and 60 per cent used daily.

Overall, one third of users smoked cannabis throughout the day, while the rest restricted themselves to evenings or other times ([23], p. 25).

A recent study of 450 cannabis-dependent adults found that, on average, the users consumed cannabis three to four times a day and were intoxicated at least six hours daily.\*

In Costa Rica, a study of 41 long-term users found that 10 cannabis cigarettes a day were smoked, but the total weight of the cannabis was only 2 grams with an average THC level of 2.2 per cent [108].

There are some studies that suggest much higher levels of use, however, as outlined below:

- In the United States, a study of 10 young people who used cannabis constantly for religious reasons found self-reported use of a mixture of tobacco and cannabis (assumed to be about 50 per cent cannabis) of 2-4 ounces a day. THC levels of the mixture were found to be 4.14 per cent. This represents the equivalent of smoking, on the high end, 56 grams or 112 standard (0.5 grams) cigarettes of pure cannabis of good quality per day, completely off the scale of other use studies [109].
- In Jamaica, Rubin and Comitas delineated three types of daily smoker: light (one to four “spliffs” daily), moderate (four to seven “spliffs”) and heavy (more than eight “spliffs”). The average level of use was seven “spliffs” of 2-3 grams of cannabis of just under 3 per cent THC, combined with tobacco. This represents an average of about 18 grams per day of rather weak cannabis, the equivalent of 36 standard 0.5 gram cannabis cigarettes.\*\* This use level has been criticized by others working in the field as “extremely excessive” and not representative of present consumption levels [110].

There are fewer studies focusing on levels of consumption of cannabis resin among heavy users. In Greece, a population of 31 users in Athens was documented, who had consumed an average of 8 grams (ranging from 2 to 24 grams) of rather weak (4 per cent) cannabis resin a day in the past. Owing to difficulties in accessing the drug, however, their current consumption levels averaged 3 grams a day.\*\*\*

### *How much cannabis do users consume in a year?*

The discussion above suggests that 162 million people use cannabis each year, of whom about 72 million could be classed “casual” users, 66 million could be classed

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\**Drug and Alcohol Findings*, No. 13 (2005), p. 10, summarizing Babor and the Marijuana Treatment Project Research Group ([107], p. 455).

\*\*Rubin and Comitas cited in Shafer and others [96].

\*\*\*Fink and others, cited in Shafer and others [96].

“regular” users, 15 million “daily” users and 7 million “chronic” users. These groups can be expected to consume at different rates.

Casual users are unlikely to finish a cannabis cigarette by themselves in any of the 1-11 sessions of use in the year. New Zealand’s figure of average consumption of 60 per cent of a cannabis cigarette was derived from data that included the 20 per cent who were heavy users and so is undoubtedly excessive for the casual-user group. More likely, these users had two to three “hits” from a 0.5 gram cannabis cigarette shared by three or four people, representing about 0.15 grams of cannabis consumption per usage session. The distribution curve for individuals who use less than 12 times a year is heavily skewed towards one to three sessions of use according to the United States data and a weighted average of this category is about four sessions per year. Thus, 72 million people smoked an average of 0.15 grams of cannabis an average of four times a year, for a total of 43.2 tons of total global consumption.

While those who do not consume cannabis on a near-daily basis are not likely to build up much tolerance to the drug and are more likely to consume the drug alone or to consume cannabis more than once in a single day of use. They are also more likely to prefer premium cannabis (which may be up to 10 times stronger) and to have a better inhalation technique (which can increase THC absorption four-fold), both of which would mean that they would require less cannabis to become intoxicated than casual users. If this assumes that these factors cancel each other out to some extent, it can also be assumed that the average use-level remains at about 0.15 grams per day of use. The distribution of responses in the United States is also skewed towards the lower end in this group, with a weighted average of about 100 days of use. This represents 66 million people smoking an average of 0.15 grams an average of 100 times a year, for a total of 990 tons of global consumption.

Daily users, according to most sources, consume between one and four cannabis cigarettes a day. The weighted average in this category, based on the United States data, is about 320 days of use. Thus, 15 million people smoked an average of one gram of cannabis per day for 320 days a year, for a total of 4,800 tons of global consumption.

Chronic users can consume huge amounts of the drug. Use patterns vary so widely that it is impossible to come up with an average, but on the basis of medical cannabis guidelines and field reports, it appears that about 10 cannabis cigarettes, or 5 grams of cannabis, is a reasonable level for fairly constant intoxication. These seven million users consume every day, so total consumption should be about 12,775 tons. Thus, based on demand-side estimates, global consumption can be estimated at about 19,000 tons. This estimate supports the frequently made assumption that “regular” (usually taken to mean “monthly”) users consume the bulk of the cannabis produced.

## Reconciling with supply-side estimates

Supply- and demand-side estimates have proved to be difficult to reconcile for a range of analysts. The *World Drug Report 2006* [111] estimates global cannabis production at about 45,000 tons and the global consumer base at 162 million people annually. Dividing the one quantity by the other results in about 277 grams per user, or over a quarter of a kilogram apiece. If we use the United States Drug Enforcement Administration figure of 0.5 grams of cannabis per cannabis cigarette, 277 grams therefore equals 554 cannabis cigarettes per year, or more than one a day per user. At United States prices of \$10 per gram, this represents \$2,770 spent on cannabis per user per year. With a United States national average per capita income of \$35,750 (according to the United Nations Development Programme), this expenditure would represent almost 8 per cent of the pre-tax income of every citizen of the United States who smoked cannabis last year. This seems impossibly high, particularly given that many users fall on the high side of this average.

Two possibilities are apparent:

- The amount of production is being overestimated, or
- The number of users is being underestimated.

The *World Drug Report 2006* [111] reports that over 6,000 tons of cannabis were seized in 2004, which would mean that 13 per cent of estimated global production is seized. Even the United States does not consolidate information on all the local seizures of cannabis made in the country, focusing instead on cross-border seizures or other large-scale operations, so this figure should be a minimum estimate. A seizure rate of more than 15 per cent seems infeasible, particularly given recent trends towards smaller-scale indoor production within consumer countries and production for personal use. Thus, it is unlikely that production is being overestimated.

The number of annual users, at nearly 4 per cent of the global population aged 15-64 years, is already incredibly high. Even doubling this rate would only halve the average consumption per annual user to 139 grams, which is still over \$1,000 a year per user in the United States. Doubling the United States annual use estimates would also mean that more than a quarter (26 per cent) of Americans aged 15-64 years spent that amount of money on an illegal drug last year.

The problem may lie with the seizure figures rather than the production figures. Countries reporting the highest seizure levels are often under intense pressure to show success in drug interdiction. Since it is unlikely that all seizures are weighed and it is likely that eradicated crops are added into the total in some cases, an element of estimation exists in generating seizure figures. In theory, the entire cannabis plant could be used for psychoactive purposes; in practice, increasing demand for high quality in today's market means that user-ready sales often

comprise the flowering tops of the cannabis plant only. Thus, seizure estimates may be dealing with a large amount of bulk matter that would never translate into saleable street product. If seizure amounts were scaled down, production figures could also be adjusted without exaggerating the interception rate.

Turning to the figures generated by the present review, demand-side estimates place global production at 19,000 tons per year. However, this is 19,000 tons of cleaned product, not 19,000 tons of the product as it is generally sold. Buyers of commercial cannabis clean their product of stems and seeds before consuming it. Since these are the heaviest parts of the plant, it is possible that half the product (by weight) as bought is not consumed.

On the supply side, an estimated 231,000 hectares are under cultivation, but the majority of these are dedicated to cannabis resin. An estimated 45,000 tons of cannabis herb and 7,500 tons of cannabis resin are produced annually, of which 6,189 tons of cannabis herb and 1,471 tons of cannabis resin were seized, leaving about 38,811 tons of cannabis herb and 6,029 tons of cannabis resin for consumers. The difference as regards herbal cannabis could be attributable to cleaning the product.

While unsatisfying, these global estimates are probably the best that can be made based on very patchy data. They are also likely to obscure the great diversity of cultivation and use patterns seen throughout the world. In the end, it makes the most sense to study cannabis locally. To highlight this point, the following section of the present review considers the cannabis markets in various regions of the world.